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PREY SELECTION BY TIGERS (*PANTHERA TIGRIS TIGRIS*) IN SARISKA TIGER RESERVE, RAJASTHAN, INDIA

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Prey selection by tigers (*Panthera tigris tigris*) was studied in Sariska Tiger Reserve, Rajasthan, India, from November 2002 to April 2003. The line transect method was used for estimating prey availability and prey selection was determined from scats. Sariska was observed to have a high wild ungulate density of 42.8 animals/sq. km, Chital (*Axis axis*) was the most common ungulate species (27.6/sq. km) followed by Sambar (*Cervus unicolor*) (8.4/sq. km) and Nilgai (*Boselaphus tragocamelus*) (5.2/sq. km). Seventy-seven tiger scats were collected and analyzed for prey remains. Scat analysis revealed that Sambar constituted the major prey species in terms of number and biomass. It was the principal and preferred prey ($P<0.05$) of tigers. Other medium to large sized prey species, including domestic livestock, contributed significantly to the tiger diet. The order of selection on the basis of prey occurrence in scats was sambar>chital>nilgai>cattle-buffalo>common langur>wild pig. It was evident that tigers were heavily dependent on sambar in greater proportion to their availability. This study provides food habits of now extinct tiger population. Two tigresses and a tiger were recently reintroduced from Ranthambhore to revive the population.

Key words: Food habits, prey selection, tiger, *Panthera tigris*, line transect, scat analysis, ungulate density

INTRODUCTION

The Tiger (*Panthera tigris* Linnaeus) occurs in a large variety of habitats showing remarkable tolerance to variation in altitude, temperature and rainfall regimes (Sunquist *et al.* 1999). There has been a drastic reduction in the distribution of the tiger in the last 100 years resulting in the extinction of three subspecies (Caspian, Javan and Bali) and massive reduction in numbers of the rest (Seidensticker 1986, 1987, 1997; Sunquist *et al.* 1999; Qureshi *et al.* 2006; Jhala *et al.* 2008). The depletion of prey populations, habitat fragmentation, disturbance and poaching are the major factors responsible for the decline of tigers in the wild (Karanth 1991; Chapron *et al.* 2008).

The tiger is the largest obligate terrestrial carnivore in any of the mammalian assemblages in which it occurs and preys on the larger ungulates living in those assemblages (Seidensticker 1997). Despite their potential to hunt a wide variety of prey animals, ranging from small mammals to large bovids, the mean weight of species hunted is around 60 kg (Biswas and Sankar 2002). This is obtained predominantly from cervids, which constitute up to 75% of the prey biomass requirement in most parts of the range (Sunquist *et al.* 1999; Biswas and Sankar 2002; Bagchi *et al.* 2003). Food habits comprise one of the major determinants of various life history patterns including spacing pattern, movement, habitat selection, social structure, success of reproduction and geographical distribution (Krebs 1978; Beckoff *et al.* 1984; Sunquist and Sunquist 1989). The factors affecting prey choice are a result of a complex interplay of various ecological parameters, which vary at the extremes of distribution of the same species (Sunquist and Sunquist 1989). Carbone and Gittleman (2002) estimated 10,000 kg/100 sq. km would support 0.33 tigers/100 sq. km. The effective size of the territory is a function of density and biomass of larger prey species in its habitat (Sunquist 1981; Karanth 1991). This makes the species vulnerable to changes in the habitat and prey abundance (Karanth 1991).

STUDY AREA

The study was conducted in Sariska Tiger Reserve (Sariska TR) (25° 5'-27° 33' N; 74° 17'-76° 34' E), Rajasthan. The total area of the Tiger Reserve is 800 sq. km, of which 302.2 sq. km is a buffer zone and 497.8 sq. km is the core zone. Sariska National Park of 273.8 sq. km was notified in 1982. The intensive study area was 45 sq. km situated in core zone I. The terrain is undulating to hilly in nature and has numerous narrow valleys and two large plateaux, Kiraska (592 m above mean sea level) and Kankwari (524 m above mean sea level).

The climate of this tract is subtropical, characterised by a distinct summer, monsoon, post monsoon and winter. Summer commences from mid-March and continues till the end of June (max temperature recorded was 44 °C in March (Sankar 1994)). The monsoon extends from June to September with the annual average rainfall ranging from 60 to 70 cm. In winter the temperature has been observed to drop to 3 °C

(Sankar 1994). The vegetation of the region falls under Northern Tropical Dry Deciduous Forest (subgroups 5 B: 5/E1 and 5/E2) and Northern Tropical Thorn Forest (sub group 6 B) (Champion and Seth 1968).

Prey species of tigers in the area include Chital (*Axis axis* Erxleben), Sambar (*Cervus unicolor* Kerr), Nilgai (*Boselaphus tragocamelus* Pallas), Common Langur (*Presbytis entellus* Dufresne), Indian Wild Boar (*Sus scrofa* Linnaeus), Four-horned Antelope or Chowsingha (*Tetracerus quadricornis* Blainville), Chinkara (*Gazella bennettii* Sykes), Rhesus Macaque (*Macaca mulatta* Zimmermann), Indian Porcupine (*Hystrix indica* Kerr), Rufous-tailed Hare (*Lepus nigricollis ruficaudatus* Geoffrey), and Indian Peafowl (*Pavo cristatus* Linnaeus). The predominant domestic livestock found inside the reserve are buffaloes (*Bubalis bubalis* Linnaeus), Brahminy cattle (*Bos indicus* Linnaeus) and goats (*Capra hircus* Linnaeus).

METHODS

Estimation of prey availability

The variable distance line transect method was used to estimate prey density in the study area (Burnham *et al.* 1980; Buckland *et al.* 1993). This method has been extensively used to determine animal densities in similar habitats (Sunquist 1981; Karanth and Sunquist 1995; Varman and Sukumar 1995; Chundawat *et al.* 1999; Biswas and Sankar 2002; Sankar and Johnsingh 2002; Bagchi *et al.* 2003; Karanth *et al.* 2004). Twelve transects were laid in the study area in a random manner. The lengths of each transect varying from 2 km to 2.4 km. All transects (24.8 km) were walked seven times during the course of the study period totalling to 173.6 km. Transects were walked early in the morning in the first three hours after sunrise when the animals are said to be most active (Schaller 1967). For each cluster of prey animals encountered on transects, the following variables were noted: (1) time (2) species (3) cluster size (4) radial distance (Using *Yardage Pro 400* Rangefinder) (5) sex and age (6) sighting angle.

The density of all prey species was calculated using the program Distance (Thomas *et al.* 2005). The analysis involved fitting of different detection functions to the observed data for estimation of densities. The best model was selected on the basis of the lowest Akaike Information Criteria (AIC) values (Burnham *et al.* 1980; Buckland *et al.* 1993).

Reconstruction of tiger diet

Hairs from the scats were observed for prey identification, because they pass undigested through the gut and can be used for species identification (Sunquist 1981; Mukherjee *et al.* 1994a,b; Karanth and Sunquist 1995). Scat analysis was used to estimate the proportion of different prey species consumed by tiger, since it is non-invasive, cost and time effective (Schaller 1967; Sunquist 1981; Johnsingh 1983; Johnsingh *et al.* 1993; Karanth and Sunquist 1995). Tiger scats were collected wherever encountered in the intensive study area. They were distinguished from leopard scats by the size of the scat and associated pugmarks as described by Sunquist (1981), Karanth and Sunquist (1995), and Biswas and Sankar (2002). Scats were washed in water, and held over a sieve. The washed hairs were sun dried and kept in zip lock bags for further analysis.

Prey species in the scats were identified based on the variables described by Mukherjee *et al.* (1994b). Sample slides were compared with reference slides available in the laboratory of the Wildlife Institute of India, Dehradun.

Estimation of biomass and number of prey

The biomass and number of individuals of the prey consumed by tiger was estimated using Ackerman's equation (Ackerman *et al.* 1984; Karanth and Sunquist 1995; Biswas and Sankar 2002; Sankar and Johnsingh 2002; Bagchi *et al.* 2003).

$Y = 1.980+0.035X$, where X = average weight of a particular prey type and Y = kg of prey consumed per field collectible scat (Ackerman *et al.* 1984).

The assumption for extrapolation of the above equation is that the tigers and cougars (*Felis concolor concolor* Linnaeus) have similar utilization and digestibility (Karanth and Sunquist 1995). We also presume that the scats containing various prey items have similar decay rate and their detection is equally probable.

Estimation of prey selectivity

Prey selectivity by tigers was estimated for each species by comparing the proportion of prey species recovered from scats with the expected number of scats in the environment for each of the prey species consumed. Frequencies of the identifiable prey remains in the scat do not tell us about the actual proportion of prey type eaten. This is more so when the prey types vary in size to a considerable degree. Smaller prey species have more undigested material (i.e., hair) due to higher body surface to mass ratio. Hence, intake of smaller body sized prey induces relatively more amount of scat production per unit mass of prey consumed leading to an over estimation of smaller prey species in the diet studies of carnivores (Floyd *et al.* 1978; Ackerman *et al.* 1984). The average weight of prey species of the tiger required for biomass estimation was taken from Karanth and Sunquist

Table 1: Individual and group densities of major Tiger prey species estimated using line transect method in Sariska Tiger Reserve, Rajasthan, November 2002 to April 2003

Species	Model	No. of Groups	Density	SE	Group Density	SE	ESW	SE	Encounter rate/km	SE
Chital	Uniform Cosine	99	27.62	7.63	5.62	0.52	51.46	4.61	0.57	0.11
Livestock	Half Normal Cosine	45	6.47	3.35	1.40	0.78	93.52	8.77	0.26	0.19
Langur	Uniform Cosine	40	14.13	4.86	6.63	1.18	54.91	2.81	0.23	0.06
Nilgai	Uniform Cosine	63	5.19	1.26	1.88	0.24	66.64	3.72	0.36	0.07
Peafowl	Half-Normal Cosine	181	20.81	6.46	1.90	0.09	47.93	3.54	1.04	0.31
Wild Pig	Half Normal Cosine	14	1.64	0.60	0.60	0.19	67.74	0.51	0.87	0.02
Sambar	Half Normal Cosine	57	8.44	2.53	2.28	0.26	40.01	5.08	0.33	0.08

Density : Individual density
SE : Standard Error
Group Density : Mean group density of each species encountered during the transect walks
ESW : Effective Strip Width
Encounter rate : Number of animals encountered per kilometer of transect walk. Total transect length walked 173.6 km.

(1995), Khan *et al.* 1996, Sankar and Johnsingh (2002).

Prey selectivity by tigers was estimated for each prey species by comparing their availability and utilization data. The expected proportion of scats in the environment (i.e., availability) was calculated using the following equation (Karanth and Sunquist 1995):

$$fi = [(di /dt) * \lambda i]/ \Sigma [(di/dt) * \lambda i],$$

where fi= expected scat proportion in the environment, di= density of i th species, dt = sum of density of all species, $\lambda i = X/Y$ the average number of collectible scats produced by tiger from an individual of i th prey species, X = average body weight of the species and Y = 1.980 + 0.035X.

Multinomial likelihood ratio test was used to evaluate prey selection of tigers in the study area (Manly *et al.* 1972; Chesson 1978; Reynolds and Aebischer 1991; Link and Karanth 1994; Karanth and Sunquist 1995). The exact variability of prey items in scats is not known and in order to account for it sensitivity analysis was done by changing coefficient of variance from 10 to 40% (Link and Karanth 1994). Program Scatman (Hines 1999) was used to do multinomial test and sensitivity analysis by bootstrapping data 5,000 times. Sample size needed to construct tiger diet was estimated by bootstrapping prey presence data in scats using program Simstat© 2.0 (Provalis Research). The variance in data significantly reduced after 60 scats suggesting that the sample size collected was adequate to reconstruct tiger diet.

RESULTS

Availability of prey species

The uniform key model fitted for density estimation of chital, common langur and nilgai. Half normal cosine was the best-fitted model for sambar, wild pig, cattle, buffalo, and peafowl (Table 1). All density estimates were done after 1% truncation of the farthest sighting data from the line transect. The highest density was of chital 27.62, followed by peafowl 20.81, common langur 14.13, sambar 8.44, livestock 6.47, nilgai 5.19 and wild pig 1.64 (Table 1). Amongst wild prey cervids contribute maximum biomass of which chital contribute maximum (1,243 kg/sq. km) followed by sambar (Table 2).

Composition of tiger diet

Altogether 87 prey items were found in 77 tiger scats collected from the study area (Table 3). The analysis of 77 tiger scats revealed the presence of seven prey species with a high preponderance of medium to large sized ungulates in the tiger's diet (Table 3). Eighty-seven per cent of tiger scat contained single prey species and 13% contained two prey species. The wild prey species in tiger scats constituted 83.9% and remaining 16.1% by domestic livestock (cattle and buffalo). Of the wild prey species sambar constituted 48.2% followed by chital (18.1%), nilgai (14.5%), common langur (4.8%) and wild pig (1.2%). Cattle and buffalo constituted 11.5% and 5.7% of the remains encountered in the tiger scats.

The wild prey base in total contributed 74.5% in terms of relative biomass of prey consumed by tiger (Table 3), of which cervids contributed 73.9% of the total biomass, and livestock (buffalo and cattle) contributed 25.5% (Table 2). Sambar contributed 254.2 kg biomass to the diet of tiger followed by nilgai (99.36 kg), cattle (82.8 kg), buffalo (57.67 kg), chital (53.32 kg), common langur (9.04 kg) and wild pig (3.31 kg) (Table 3).

Estimation of prey selectivity

Sambar was consumed by tiger more than expected on basis of the availability of individuals and groups (Tables 4a,b and 5). Chital utilization was proportionally less than available group and individual density. Common Langur

Table 2: Frequency of occurrence of food items in 77 Tiger scats and contribution of different prey species in terms of biomass to the Tiger diet in Sariska Tiger Reserve (November 2002 to April 2003)

Prey species	Average Body weight (X)	Prey species remains (F=87)	Percent occurrence of prey species (n = 77)	Relative occurrence (R) in %	Number of collectible scats produced per kill (Y)	Prey biomass consumed B = F*Y	Percentage relative biomass of prey contribution (P = F*R in %)
Chital	45	15	19.48	17.24	3.55	53.32	9.52
Sambar	125	40	51.95	45.97	6.35	254.2	45.41
Nilgai	180	12	15.58	13.79	8.28	99.36	17.75
Wild Pig	38	1	1.3	1.14	3.31	3.31	1.59
Domestic Buffalo	273	5	6.49	5.74	11.53	57.67	10.03
Domestic Cattle	180	10	12.99	11.49	8.28	82.8	14.79
Common Langur	8	4	5.19	4.59	2.26	9.04	1.61
						559.71	

X = Average body weight of an individual prey type in kg
Y (kg of prey consumed per field collectible scat) = 1.980+0.035 X (Ackerman *et al.* 1984)

and Wild Pig were used in proportion to their available individual density and in less proportion to their group density (Tables 4a,b and 5). Nilgai was utilized in proportion to their available individual and group density (Tables 4a,b and 5). Based on the index of selection at individual level the prey species used by tiger were ranked as sambar > nilgai > wild pig > cattle and buffalo > common langur > chital. Ranking on the basis of group density was in the following order: sambar > cattle and buffalo > nilgai > chital > wild pig > common langur. The order of selection on the basis of prey occurrence in scats was sambar > chital > nilgai > cattle-buffalo > common langur > wild pig.

DISCUSSION

Availability of prey species

Chital were the most abundant wild ungulate species in Sariska study area. However, the crude density estimates for Chital in Sariska were less than other protected areas in India; Pench (Biswas and Sankar 2002), Kanha, Nagarhole (Karanth and Nichols 1998), Gir (Khan *et al.* 1996) and Bandipur (Johnsingh 1983). Chital was also the least widespread of the three large wild ungulates found in the study area. Chital had a clumped distribution pattern, largely encountered in the valleys interspersed between the hills and in areas in the plains, which had a tall vegetation cover with least disturbance.

Sambar density in the study area (8.44 animals/sq. km) was higher than the density figures obtained for Kanha, Nagarhole (Karanth and Nichols 1998), Mudumalai (Varman and Sukumar 1995), Chitwan (Seidensticker 1976). Sambar densities in Sariska can be compared with protected areas like Pench (Biswas and Sankar 2002) and Bandipur (Johnsingh 1983). Sambar is predominantly a browser and has evolved in forest environment (Eisenberg and Lockhart 1972). Its abundance in any particular area probably is limited by the dispersion of browse species in the forest, the phenophase of browse species and water availability (Sankar

Table 3: The estimated biomass of prey species in Sariska Tiger Reserve (November 2002 to April 2003)

Species	Density/sq. km	Confidence Interval		Avg. Body weight (kg)	Mean Biomass sq. km (kg)	Confidence Interval	
		Lower	Upper			Lower	Upper
Chital	27.62	19.98	35.25	45	1,242.9	899.23	1,586.56
Livestock	06.47	03.11	09.82	217	1,403.99	675.73	2,132.24
Common Langur	14.13	09.26	18.99	8	113.04	74.09	151.98
Nilgai	05.19	03.92	06.45	180	934.2	706.68	1,161.72
Peafowl	20.81	14.34	27.27	4.2	87.40	60.26	114.53
Wild Pig	17.52	16.91	18.12	38	665.76	642.69	688.82
Sambar	08.44	05.90	10.97	125	1,055	738.62	1,371.37
Total (kg)					5,503.37	3,797.33	7,207.25

Table 4a: Preference of prey species by tiger in Sariska Tiger Reserve based on availability of individuals and utilization based on scat data (November 2002 to April 2003)

Species	Chi-square value	Un-adjusted P-value	Adjusted P-value 10% CV	Adjusted P-value 20% CV	Adjusted P-value 30% CV	Adjusted P-value 40% CV	Ivlev's index
Chital	11.18	0.001	0.00	0.00	0.00	0.03	-0.34
Sambar	54.82	0	0	0	0	0	0.48
Cattle & Buffalo	05.75	0.01	0.03	0.03	0.03	0.04	-0.27
Common Langur	01.00	0.31	0.32	0.32	0.32	0.33	-0.32
Nilgai	00.32	0.56	0.57	0.57	0.58	0.58	0.08
Wild Pig	00.16	0.68	0.68	0.68	0.68	0.68	-0.19

1994; Biswas 1999). Of the two cervids, sambar was the most widely distributed in the study area. This may be attributed to the fact that a large portion of the terrain is hilly in the study area that was relatively undisturbed.

Nilgai density in the study area was observed to be 5.2 animals/sq. km, which is comparable to the Royal Bardia National Park (RBNP) (Dinerstein 1980). It is higher than the nilgai densities recorded in Pench (Biswas and Sankar 2002) and Gir (Khan *et al.* 1996). Nilgai was observed to be widely distributed across the entire study area. However, their occurrence was recorded more in the plains than in the hills. This could be attributed to their higher tolerance of anthropogenic pressure than the cervids. The nilgai's wide dispersal in Sariska TR was attributed to its tolerance of disturbance (Sankar and Johnsingh 2002).

The observed density for wild pigs (1.64 animals/ sq. km) was lower than recorded densities in other studies – Pench: 2.6 animals/sq. km (Biswas and Sankar 2002), Nagarhole: 3.3 animals/sq. km (Karanth and Sunquist 1995), Bandipur: 2.5 animals/sq. km (Johnsingh 1983), Royal Bardia National Park: 4.2 animals/sq. km (Dinerstein 1980) and Chitwan: 5.8 animals/sq. km (Seidensticker 1976) (Table 5). Though Chowsingha was not encountered during transect walks, their pellet groups were recorded along transects. This showed the presence of chowsingha in the study area. Sankar (1994) reported low occurrence of chowsingha in Sariska. Common Langur density in the study area was observed to be 14.1 animals/sq. km. It was observed to be very low compared to the density recorded in Pench, which was 77.2 -animals/sq. km (Biswas and Sankar 2002).

Domestic cattle and buffalo were distributed largely in the plains, their combined density was 6.47 individuals/ sq. km. Buffaloes and goats were accompanied by villagers in the forest, whereas the cattle were left unattended.

Prey Selection by tigers

Sambar were observed to be the principal prey species for tigers as inferred from the percentage occurrence of prey remains in scats (Table 3). Sambar also contributed to the highest biomass of prey consumed by the tiger. Sambar was selected in greater proportion than its available group and individual densities.

Of the prey remains encountered in scats, sambar constituted the maximum amounting to 46% of the total. This is high compared to the frequency observed in Pench – 13.8%, (Biswas and Sankar 2002), Kanha – 10.4% (Schaller 1967) and Nagarhole – 34.9% (Karanth and Sunquist 1995) (Table 6). Sambar ranked first in terms of frequency of occurrence in scats, which is not observed in all previous studies (Table 6). Chital constituted 17.2% of the total prey

Table 4b: Preference of prey species by tiger in Sariska Tiger Reserve based on availability of groups and utilization based on scat data (November 2002 to April 2003)

Species	Chi-square value	Un-adjusted P-value	Adjusted P-value 10% CV	Adjusted P-value 20% CV	Adjusted P-value 30% CV	Adjusted P-value 40% CV	Ivlev's index
Chital	05.31	0.02	0.03	0.03	0.03	0.03	-0.25
Sambar	34.17	0.001	0.001	0.001	0.001	0.001	0.38
Cattle & Buffalo	00.06	0.79	0.82	0.82	0.82	0.82	0.03
Common Langur	05.68	0.01	0.01	0.02	0.02	0.02	-0.62
Nilgai	01.68	0.19	0.21	0.22	0.23	0.25	-0.17
Wild Pig	00.96	0.03	0.33	0.33	0.33	0.33	-0.43

Table 5: Densities of ungulate species from different areas in south Asia

Species	PNP	RAN	KNH	NGH	BDP	MML	RBNP	CTW	STR
Chital	80.75	31.05	49.7	38.1	43	25.03	29.7	17.3	27.62
Sambar	6.09	17.15	1.5	4.2	8-9	6.61		2.9	8.44
Wild Pig	2.59	9.77	2.5	3.3	2.5		4.2	5.8	17.52
Gaur	0.34			4.5	0.5	14.38			
Nilgai	0.43	11.36					5.0		5.19
Chowsingha	0.29								
Muntjac			0.6	6.0	1		1.7	6.7	
Chinkara		5.2							
Barasingha			3.0						

PNP (Pench National Park) - Biswas & Sankar (2002); RAN (Ranthambhore) - Bagchi *et al.* (2003); KNH (Kanha) & NGH (Nagarhole) - Karanth & Nichols (1998); BDP (Bandipur) - Johnsingh (1983); MML (Mudumalai) - Varman & Sukumar (1995); RBNP (Bardia) - Dinerstein (1980); CTW (Chitwan) - Seidensticker (1976), STR (Sariska) Present study 2002

remains in tiger scat in Sariska, which is less than that was observed in other studies – Pench 53%, (Biswas and Sankar 2002), Kanha 52.2% (Schaller 1967), Nagarhole 31.2% (Karanth and Sunquist 1995) and Bandipur 39% (Johnsingh 1983) (Table 6).

Nilgai remains were observed in 13.7% of the scats. This is higher than the percentage observed for all other areas mentioned above. Sankar and Johnsingh (2002) reported the occurrence of remains of rodents, insectivore, chowsingha, peafowl (*Pavo cristatus*) and Grey Francolin (*Francolinus pondicerianus*) in tiger scats in Sariska. However, during the present study the remains of these species were not observed. Remains of domestic cattle was recorded in the present study, but not reported earlier (Sankar and Johnsingh 2002).

The preference for sambar could be attributed to the larger body weight and wide distribution of sambar across the study area thereby the higher frequency of encounter. The tiger distribution range also coincided with the good sambar habitat in the reserve. Nilgai were selected in proportion to their available individual density and were second in terms of biomass contribution to the tiger diet. Chital were selected in less proportion to their available individual and group density, and were fifth in terms of biomass

Table 6: Frequency of occurrence of major prey species in Tiger (*Panthera tigris tigris*) scats from different areas of the Indian subcontinent

Species	Sariska	Kanha	Bandipur	Nagarhole	Chitwan-1	Chitwan-2	Bardia	Pench	Sariska-1	Ranthambhore
Chital	17.24	52.2	39	31.2	33.3	61.8[a]	77.7	53.01	33.19	45.67
Sambar	45.97	10.4	30.5	34.9	29.3	20		13.78	31.51	36.86
Muntjac				6.1	4.1			5.34		
Barasingha		8.6					1.4			
Hog Deer					15.4		7.7			
Wild Pig	1.1	0.8[b]	5.5	9.4	10.6	3.6	8.8	8.88		2.89
Gaur		8.3	5.5	17.4						
Nilgai	13.79						1.9		1.26	3.27
Chowsingha								2.67	2.1	
Chinkara										0.58
Common Langur	4.59	6.2		3.9	5.7	3.6	2.3	3.65	10.08	4.86
Cow	11.49	5.9	5.5[c]			1.8[c]		4.34		2.89
Buffalo	5.7	1.7						2	1.26	2.6
Others	0	6.1	14	7.1	1.6	9	5.2	6.33	20.58	

a: Includes percent occurrence of Chital, Hog Deer and Muntjac

b: Both domestic and Wild Pigs

c: Domestic livestock as a whole

Kanha - Schaller (1967); Bandipur - Johnsingh (1983); Nagarhole - Karanth & Sunquist (1995); Chitwan-1 - McDougal (1977); Chitwan-2 - Sunquist (1981); Bardia - Stoen & Wegge (1996); Pench - Biswas & Sankar (2002); Sariska-1- Sankar & Johnsingh (2002); Ranthambhore - Bagchi *et al.* (2003)

contribution to the tiger diet. Chital were the least widespread of the three ungulates and their distribution was clumped thereby reducing the frequency of encounter.

Different factors like abundance of the prey species, temporal and spatial distribution, size, defences, and anti-predator tactics determine the predator choice (Sunquist and Sunquist 1989). For tigers in the Indian subcontinent, sambar and chital constituted the main prey base wherever they occur in considerable numbers (Schaller 1967; Tamang 1979; Sunquist 1981; Johnsingh 1983; Johnsingh *et al.* 1993; Stoen 1994; Karanth and Sunquist 1995). Other common prey species of tiger are wild pig, gaur and nilgai (Biswas and Sankar 2002; Sankar and Johnsingh 2002).

Mammalian carnivores are characterized by classic relationship with their prey. It seems that carnivores are closely tied not only to prey size, but also to prey biomass (Karanth and Nichols 1998; Carbone and Gittleman 2002; Karanth *et al.* 2004). Carbone and Gittleman (2002) suggested that 10,000 kg of prey support about 90 kg of a given species of carnivore irrespective of body mass and that the ratio of carnivore number to prey productivity scales to carnivore mass near -0.75, and that the scaling rule can predict population density across more than three order of the magnitude. Prey density is critical to maintenance of a large carnivore population. Habitat loss, poaching and prey loss are most critical factors determining tiger population (Cardillo *et al.* 2004; Chapron *et al.* 2008). Looking at the current socio-political scenario it is important to maintain core-breeding areas for tigers at landscape level. In any given Protected Area it is important to maintain mini-cores as a source area for tiger and its prey. In Sariska Tiger Reserve, the Sariska-Kalighati – Pandupole valley (*c.* 80 sq. km) is the only area that can be considered as mini-core. As the rest of the Park area is disturbed due to the anthropogenic pressure, having very low wild ungulate density, and hence it can support only a few tigers (Johnsingh *et al.* 1997).

Wikramanayake *et al.* (1999) classified the Sariska Tiger Reserve as Tiger Conservation Unit 3 (TCU 3) among the dry deciduous habitat types. The long-term survival of tigers in such units is threatened due to various anthropogenic factors. These areas require active interference to prevent the extinction of tigers. In the study area, evidences of tiger (tracks, signs, scats) were recorded only from the hilly tracks, which is relatively undisturbed. This forms a very small area (*c.* 80 sq. km) of the Core Zone I and corresponds to the area where there is a high wild cervid density (Sankar 1994; Sankar and Johnsingh 2002). The reported total tiger population in the entire Tiger Reserve was 26 (Anon. 2002), a gross over estimate. The maximum of 15 tigers would have been supported by prey density, based on the equation of Karanth *et al.* (2004). Tiger population got extinct in 2004 due to poaching, but proximate causes were isolation, habitat degradation and loss of prey from a large area.

Denial of poaching, long history of passive management, inaction, carnivore-people conflict, lack of interest and organized poaching were the reasons of extinction of tiger. If we forget these and fail to respond in appropriate time, there might be many more extinctions. It is now extremely important to relocate villages with appropriate package to make available the meaningful area to sustain demographically viable tiger population. There are 12 villages located in the proposed national park of the tiger reserve and are due for relocation (Sankar 1994; Johnsingh *et al.* 1997). In 2006-07, Bhagani village was relocated; rest are in process of relocation. This will make available 120 sq. km of intact forest (Sankar 1994; Johnsingh *et al.* 1997). Two tigresses and a tiger were reintroduced in 2007-2008 from Ranthambhore.

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